REMARKS

In section 1 of the Office Action, the Examiner noted that applicant is required to make reference to the parent application in the first sentence of the application. The Examiner's attention is directed to the Preliminary Amendment filed with the present application. The Preliminary Amendment amended page 1 of the present application by adding a sentence making reference to the parent application. Therefore, applicants have perfected their claim of priority to the parent application.

In section 3 of the Office Action, the Examiner rejected claims 60-65 and 70-72 under 35 U.S.C. §103(a) as being unpatentable over Khayrallah.

Khayrallah describes a system 10 having a transmitter 12 and a receiver 22. The transmitter 12 is connected to an antenna 14. The receiver 22 is connected to a plurality of antennas 16 and includes an RF processor 18 and a baseband processor 20. The transmitter 12 transmits an information signal, and the transmitted information signal plus any noise in the channel are received by the receiver 22. The received information signal is amplified, mixed, filtered, sampled, and quantized by the RF processor 18 to extract

the baseband signal. The baseband processor 20 demodulates the baseband signal.

As shown in Figure 2, a radiotelephone 30 includes the receiver 22, and also includes a transmitter 33, a user interface 36, and an antenna system 38. As further shown in Figure 2, the baseband processor 20 includes a path estimator 32.

As shown in Figure 3, the path estimator 32 includes a channel tracker 50, an antenna tracker 52, and a mode selector 56. The channel tracker 50 tracks time dispersion characteristics of the channel, the antenna tracker 52 estimates spatially correlated interference based on signals from the spatially separated antennas 16, and the mode selector 56 changes between a training mode to a decision directed mode. During the training mode, known training symbols in the received information signal are used by the path estimator to adjust the taps of an equalizer 54. During the decision directed mode, unknown but detected symbols are used by the path estimator to adjust the taps of the equalizer 54.

The baseband processor 20 includes the equalizer 54 and also an error correction decoder 58. The equalizer 54 receives both the tap values from the path estimator 32 and the received information signal

from the antennas 16, and the equalize estimates the symbols in the received information signal. The equalizer 54 provides its output to the mode selector 56 and to the error correction decoder 58. The error correction decoder 58 decodes the estimated symbols, and feeds the decoded symbols back to the path estimator 32.

The mode selector 56 re-encodes the decoded symbols, selects the mode of the path estimator 32 as discussed above, and provides the re-encoded symbols to the remaining portions of the path estimator 32.

The equalizer 54 provides detected symbols to the path estimator 32. The channel tracker 50 of the path estimator 32 uses the detected symbols (known training symbols or unknown detected symbols) and the received signal to update the channel taps c_0 . . . , c_M. The antenna tracker 52 of the path estimator 32 uses the detected symbols (known training symbols or unknown detected symbols) and the received signal to update a correlation matrix R_k. The impairment correlation estimator 52 apparently uses the correlation matrix R_k to estimate spatially correlated interference based on the signals from the spatially diverse antennas 16. The output of the antenna tracker 52 is provided to the equalizer 54. However, Khayrallah does not disclose how

the impairment correlation estimator 52 uses the correlation matrix R_k, and Khayrallah does not disclose what the equalizer does with the output of the antenna tracker 52. Khayrallah merely states that, at the beginning of a received slot, initial channel estimates of the channel tracker 50 are provided to the antenna tracker 52 in order to initialize its estimate of the channel spatial diversity characteristics.

The re-encoded symbols from the decoder 58 are allegedly used to constrain the transitions of the trellis of the equalizer 54 to insure that, on the second demodulation pass, the detected symbols correspond to the re-encoded decoded symbols.

Figure 4 of Khayrallah illustrates a slot that includes a synchronizing portion 0 to A containing pre-defined (known) training symbols, information portions B-C, F-G and J-K associated with unencoded unknown symbol information, and information portions D-E, H-I and Y-Z associated with encoded unknown symbol information.

During the synchronizing period of each slot, the mode selector 56 provides known training symbols to the path estimator 32, and the path estimator 32 makes initial channel estimates in order to track the channel. These initial estimates are used as initial estimates for

the channel tracker 51 and antenna tracker 52. After the training sequence (i.e., after the synchronizing period), the mode selector 56 changes from the training mode to the decision directed mode during which the output from the equalizer 54 is used by the channel tracker 50 and antenna tracker 52. The decision directed mode continues until the next training symbol period.

During the second modulation pass, the mode selector 56 uses the decoded symbols from the first pass to update the channel tracker 50 and the antenna tracker 52.

According to Khayrallah, symbols re-encoded from the symbols decoded by the decoder 58 during a first pass demodulation and the received signal are used to calculate an error, and this error is used to update the channel estimate. Khayrallah asserts that this updated channel estimate allows the channel tracker 50 to more accurately track changes in the channel through which the transmitted information signal reaches the receiver 22.

At a block 100 of the flow chart of Figure 5, the receiver 22 receives a modulated information signal and buffers a slot of the received modulated information signal. At a block 102, the propagation characterization of the channel over which the received signal was

transmitted is initialized using the synchronization period of the received modulated information signal. At a block 104, the received modulated information signal is demodulated during a first demodulation pass while updating the channel tracker 50 and the antenna tracker 52 at a base bandwidth appropriate for updates based on detected rather than known symbols. At a block 106, the detected symbols from the equalizer 54 are decoded by the decoder 58.

At a block 108, the received slot is again demodulated during second pass demodulation. However, unlike the first pass of demodulation, during second pass demodulation, the decoded symbols from the decoder 58 are re-encoded, and the re-encoded symbols are used to update the channel tracker 50 and the antenna tracker 52 (although Khayrallah does not disclose how the re-encoded symbols are used to update the channel tracker 50 and the antenna tracker 52).

At a block 110, the detected symbols from the second pass are decoded by the decoder 58 and are provided to the user interface 36.

<u>Independent claim 60</u> - As can be seen from the above description of Khayrallah, Khayrallah fails to disclose decoding a code vector such that the decoding

includes deriving a constellation of received signal values corresponding to the code vector, and generating a reliability factor based upon at least one of the received signal values such that the reliability factor is a measure of reliability of the decoding.

The Examiner apparently asserts that the error mentioned in column 12 of Khayrallah somehow corresponds to reliability. However true that assertion may be, it is not true that the error mentioned in column 12 of Khayrallah corresponds to the reliability of the decoder 58 of Khayrallah. The error mentioned in column 12 of Khayrallah is simply the difference between the signal as received and the signal as processed by the receiver 22. The only insight that this error might provide regards the nature of the channel. This error provides no insight as to the reliability of the decoding. Indeed, the decoding could be perfect or less than perfect, and yet the error can not tell the difference.

By contrast, the reliability as recited in independent claim 60 is a measure of the reliability of the decoding.

Accordingly, Khayrallah does not disclose the reliability feature of independent claim 60.

Moreover, the decoding reliability of independent claim 60 would not have been suggested to one of ordinary skill in the art. Certainly, Khayrallah would not have led the person of ordinary skill in the art to provide decoding reliability. Indeed, Khayrallah only discusses an error that is useful in determining channel effects so that the taps of the equalizer 54 can be properly adjusted. This error indicates nothing about the reliability of the decoder 58.

Accordingly, because there is no suggestion to one of ordinary skill in the art to provide a reliability measure in the system disclosed in Khayrallah, independent claim 60 is not unpatentable over Khayrallah.

Because independent claim 60 is not unpatentable over Khayrallah, dependent claims 61-65 and 70-72 are likewise not unpatentable over Khayrallah.

In addition, dependent claim 63 states that the decoding reliability is determined based upon a difference between two of the received signal values included in the constellation of received signal values. Khayrallah discloses only an error, and the error is determined as the difference between the received signal and the re-encoded output of the decoder 58, not between

two received signal values included in the constellation that is derived during decoding.

The Examiner points to Figure 3, to column 8, lines 19-42, and to column 12, lines 35-45 of Khayrallah for the features of dependent claim 63. Figure 3 is merely a block diagram of the baseband processor 20 and does not show how any reliability is determined.

Column 8, lines 19-42 of Khayrallah state that the output of equalizer 54 is de-interleaved and then fed to the decoder 58, and that the output of decoder 58 is re-encoded, re-interleaved, and fed back for use by the equalizer 54 during a first demodulation pass as decoded estimates of the received signal. As can be seen, there is no disclosure or suggestion in this portion of Khayrallah of determining decoding reliability based on a difference between constellation values that are derived as part of the decoding process.

Column 12, lines 35-45 of Khayrallah merely describe the error between the signal as received and the signal from the decoder 58 as re-encoded. As discussed above, there is no disclosure or suggestion to one of ordinary skill in the art that this error is a measure of decoding reliability.

Accordingly, because there is no disclosure or suggestion to one of ordinary skill in the art to provide, in the system disclosed in Khayrallah, a reliability measure as recited in dependent claim 63, dependent claim 63 is not unpatentable over Khayrallah.

For substantially the same reasons, dependent claim 64 is not unpatentable over Khayrallah.

With respect to dependent claim 64, the Examiner discusses tap values. However tap values are the values to which the taps of the equalizer 54 of Khayrallah are set as a result of the processing performed by the path estimator 32. No difference between tap values is computed according to Khayrallah in order to provide a measure of decoding reliability. The material in column 13 of Khayrallah cited by the Examiner relates to pre-defining certain parameters of the channel tracker 50. This material has nothing to do with forming a difference that is indicative of decoding reliability.

Dependent claim 70 recites that the received signal values in the constellation are correlation peaks. There is no description in Khayrallah of correlation or correlation peaks that are useful in determining decoding reliability.

The Examiner asserts that Khayrallah discloses a correlation estimator at column 7, lines 38-50. This portion of Khayrallah states that the impairment correlation estimator 52 estimates spatially correlated interference based on the signals from the spatially diverse antennas 16. As can be seen, this impairment correlation estimator 52 does not suggest using correlation in order to provide correlation peaks that are used to derive a decoding reliability.

Accordingly, because there is no disclosure or suggestion to one of ordinary skill in the art to use, in the system disclosed in Khayrallah, correlation peaks in order to generate a decoding reliability measure, dependent claim 70 is not unpatentable over Khayrallah.

<u>Dependent claim 71</u> states that the decoding reliability is determined based upon a difference between the squares of two of the received signal values included in the constellation of received signal values.

As discussed above, Khayrallah does not disclose a decoding reliability based on the difference between two received signal values included in the constellation that is derived during decoding. Therefore, Khayrallah cannot disclose a decoding

reliability based on the difference between the squares of two such values.

Accordingly, because there is no disclosure or suggestion to one of ordinary skill in the art to provide, in the system disclosed in Khayrallah, a reliability measure as recited in dependent claim 71, dependent claim 71 is not unpatentable over Khayrallah.

Dependent claim 72 is not unpatentable over Khayrallah for similar reasons.

In section 4 of the Office Action, the Examiner rejected claims 66-69 under 35 U.S.C. §103(a) as being unpatentable over Khayrallah in view of Molnar.

Molnar describes receiving data from a channel where the data is transmitted as a plurality of sequential symbols. Each symbol is determined as a function of a previous symbol and a differential symbol corresponding to a portion of the data being transmitted.

An initial differential MAP symbol estimation provides initial estimates of the differential symbols. New received symbol estimates are calculated using the initial estimates of the differential symbols. A subsequent differential MAP symbol estimation provides improved estimates of the differential symbols. Bit

probability calculations are performed on the improved estimates.

The estimates of the bit values are decoded. The decoded estimates of the bit values are re-encoded as re-encoded received symbol estimates, a subsequent differential MAP symbol estimation provides further improved estimates of the differential symbols based on the re-encoded received symbol estimates, and bit probability calculations can be performed on the further improved estimates of the differential symbols.

The decoded bits are re-encoded by a re-encoder 77 to provide a new set of coherent symbols that are stored in a coherent symbol memory 95 of an equalizer 71. These new coherent symbols are used to calculate new values r_n that are useful in calculating differential symbols b_n according to the equation $b_n = r_n^T b_n$.

A decoder 75 performs a decoding validity check using, for example, a CRC check or other error detection and/or correction techniques. In the event that the decoder 75 performs the decoding validity check on all bits, the re-encoder 77 generates new coherent symbols corresponding to all bits. In this event, all new coherent symbols are substituted for all corresponding symbols in the symbol memory 95.

However, in the event that the decoder 75 does not perform the decoding validity check on all bits, the re-encoder 77 only generates new coherent symbols corresponding to bits on which the decoding validity check has been performed. In this latter event, only the new coherent symbols are substituted for corresponding symbols in the symbol memory 95 while the other symbols in the symbol memory 95 are left unchanged.

The r_n values can thus be improved based on decoding and re-encoding followed by subsequent log-likelihood and symbol probability calculations. During these subsequent log-likelihood and symbol probability calculation, the symbol memory 95 is revised only for those symbols that do not correspond to decoded bits.

As can be seen, Molnar also does not disclose or suggest generating a reliability factor based upon at least one received signal value in a constellation of received signal values, where the reliability factor is a measure of reliability of the decoding.

Molnar does mention performing a validity using a CRC or other error detection and/or correction technique. However, the validity check does not result in a reliability factor. It is merely used to determined which symbols in the symbol memory 95 should be changed.

Moreover, a CRC or other error detection and/or correction technique merely indicates whether data is correctly received, not whether data is corrected decoded. That is, a CRC or other error detection and/or correction technique is not derived from the decoding process.

Accordingly, because there is no disclosure or suggestion to one of ordinary skill in the art to provide a reliability measure in the systems disclosed in Khayrallah and Molnar, independent claim 60 is not unpatentable over Khayrallah in view of Molnar.

Therefore, because independent claim 60 is not unpatentable over Khayrallah in view of Molnar, dependent claims 66-69 likewise are not unpatentable over Khayrallah in view of Molnar.

In addition, dependent claim 66 recites that the reliability factor is generated based upon a comparison of the one received signal value to a threshold.

The Examiner points to column 3, lines 28-41 of Molnar for a discussion of thresholds. This portion of Molnar states that the steps of calculating the new received symbol estimates and performing subsequent differential MAP symbol estimation can be repeated until

the improved estimates of the differential symbols converge to within a predetermined threshold. In other words, symbols are iteratively estimated until the differential symbols are close to a threshold value.

As can be seen, there is no suggestion here of comparing constellation values to a threshold in order to generate a decoding reliability.

For this additional reason, dependent claim 66 is not unpatentable over Khayrallah in view of Molnar.

Dependent claims 67-69 are not unpatentable over Khayrallah in view of Molnar for similar reasons.

Newly added independent claim 73 is directed to a method in which a signal containing a code vector is received. The received code vector is decoded, and the decoding includes correlating the received code vector with a plurality of reference code vectors so as to produce a plurality of values. The values correspond to an amount of correlation between the received code vector and the reference code vectors. A reliability factor is generated based upon at least one of the values, wherein the reliability factor is a measure of the reliability of the decoding.

There is no disclosure in either Khayrallah or Molnar of correlating a received code vector with a

plurality of reference code vectors so as to produce a plurality of values corresponding to an amount of correlation between the received code vector and the reference code vectors, and there is no disclosure in either Khayrallah or Molnar of generating a reliability factor based upon at least one of the values such that the reliability factor is a measure of the reliability of the decoding.

Therefore, independent claim 73 is not unpatentable over Khayrallah and/or Molnar.

Newly added independent claim 79 is directed to receiving a signal containing a code vector, and deriving a constellation of a plurality of sets of values corresponding to the code vector. One of the sets contains a value that is largest. The code vector is decoded according to the set of values containing the largest value. A reliability factor is generated based upon at least one of the values such that the reliability factor is a measure of the reliability of the decoding.

There is no disclosure in either Khayrallah or Molnar of deriving a constellation of a plurality of sets of values corresponding to the code vector such that one of the sets contains a value that is largest, there is no disclosure in either Khayrallah or Molnar of decoding the

code vector according to the set of values containing the largest value, and there is no disclosure in either Khayrallah or Molnar of generating a reliability factor based upon at least one of the values such that the reliability factor is a measure of the reliability of the decoding.

Therefore, independent claim 79 is not unpatentable over Khayrallah and/or Molnar.

Because independent claims 73 and 79 are not unpatentable over Khayrallah and/or Molnar, dependent claims 74-78 and 80-84 likewise are not unpatentable over Khayrallah and/or Molnar.

CONCLUSION

In view of the above, allowance of these claims and issuance of the above captioned patent application are respectfully requested.

The Commissioner is hereby authorized to charge $250 (5 additional dependent claims), and any additional fees which may be required, or to credit any overpayment to Account No. 26 0175.

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